Theme 7. OTHER SDI SERVICES

1. In the preceding themes we have discussed three types of services that are fundamental to any SDI: Data Catalogues, Web Mapping and data access.

2. Additional services that extend functionality over the Web by combining data from sources described in Theme 6 are described here.

3. The application of special services, and service chaining, hold great promise in realizing true Web-based GIS interactions on data in support of decision making.

7.1. Context and rationale of SDI services

1. Services can be defined as self-contained, self-describing, modular applications consisting of collections of operations, accessible through interfaces, which allow clients to evoke behaviors of value to the user.

2. Clients can invoke services from across a network using standardized protocols independently of platform, language, or object model on which the services or the client were deployed.

3. By building applications to common service interfaces, applications can be built without a-priori or run-time dependencies on other applications or services.

4. Applications and services can be added, modified, or replaced without impacting other applications.

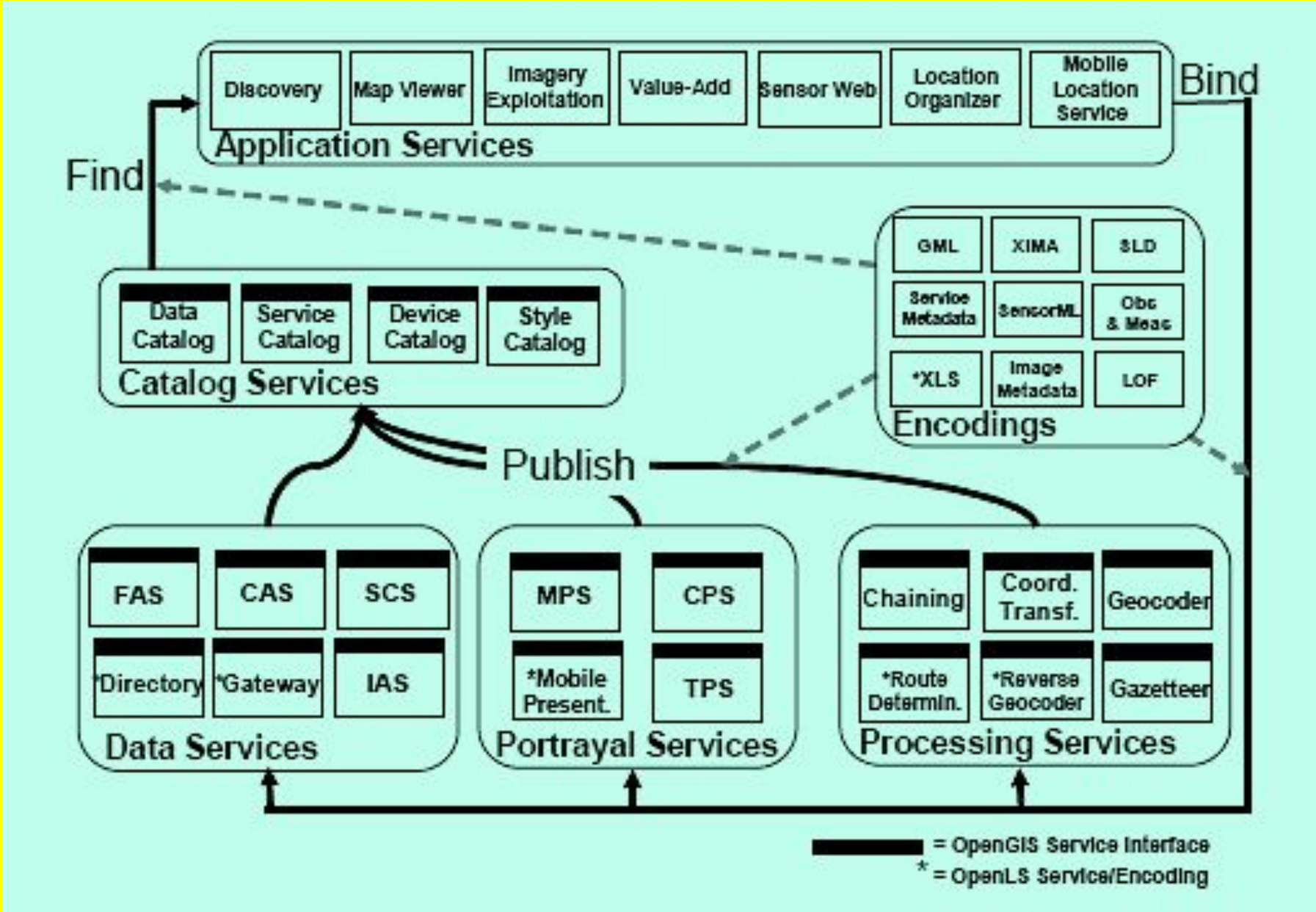
7.2. Organisational approach to SDI services

1. As described in the OGC Service Framework, a broad range of other geospatial services may exist in SDIs.

2. The **OGC Service Framework** (shown in *Figure 7.1*) identifies services, interfaces and exchange protocols that can be utilized by any application.

3. The framework, which can be implemented in different ways, primarily provides a basis for coordinated development of new and extended spatial services.

Fig.7.1 – The OGC Service Framework



4. The OGC Service Framework groups spatial services into **five categories** (*Table 7.1*) corresponding to the OGC services taxonomy top-level domains described in OGC's Service Architecture Abstract Specification (also ISO 19119).

5. By providing a summary of these categories, this theme is intended to help you decide on the right mix of services that you need in your applications.

6. **Service Chaining** is distinguished as one more category of services.

Table 7.1 – Categories of the OGC Service Framework

Service Framework Service Categories	ISO 19119 Service Categories
Application Services	Geographic Human Interaction
Catalog Services	Geographic Information Management
Data Services	Geographic Information Management
Portrayal Services	Geographic Human Interaction
Processing Services	Geographic Processing Interaction

7.2.1. Spatial Application Services:

1) Operate on user terminals (e.g. desktop, notebook, handset, etc.) or servers to provide access to the various services described below;

2) Are used by users to access Catalog, Data, Portrayal and Processing Services depending on the requirements and the designed implementation of the application;

3) Often provide user-oriented displays of spatial content and support user interaction at the user terminal.

7.2.2. Catalogue Services:

– Catalogue Services are described in detail in Theme 4.

7.2.3. Spatial Data Services

1. **Spatial Data Services** provide access to a wide range of collections of spatial data stored in distributed **repositories and databases**. ***Examples of data services*** include:

1) **Feature Access Services (FAS)**:

a) Provide access and management of feature stores;

b) *Applicable implementation specification: OGC Web Feature Service (WFS) (See Theme 6);*

2) **Coverage Access Services (CAS)**:

a) Provide access and management of coverage stores;

b) *Applicable implementation specification: OGC Web*

3) **Sensor Collection Services (SCS)**:

a) Provide access, manipulation and collection of sensor observations;

b) *Applicable implementation specification: OGC Sensor Collection Service (SCS)*;

4) **Image Archive Services**:

– Provide access and management of large sets of digital images and related metadata.

2. **Spatial Data Services** also provide access to **location-based data** in the form of the ***following services*** *(Applicable implementation specification: OGC Location Services, OLS)*:

1) **Directory Services**:

– Provide access to online directories to find the locations of specific or nearest places, products or services;

2) **Geocoding Services**:

– Transform a description of a location into a normalized description of the location;

3) **Navigation Services**:

– Determine travel routes and navigation between two points;

7.2.4. Portrayal Services:

1) Provide visualization of spatial information;

2) Given one or more inputs, services produce rendered outputs (maps, perspective views of terrain, annotated images, etc.);

3) Can be tightly or loosely coupled with other services such as the Data and Processing Services;

4) Can transform, combine, or create portrayed outputs;

5) ***Examples of such services*** include:

a) **Map Portrayal Services (MPS)**:

– Described in detail in Theme 5 (See WMS).

b) **Coverage Portrayal Services (CPS)**:

– *Applicable implementation specification: OGC Coverage Portrayal Service (CPS)*;

c) **Mobile Presentation Services** etc.

7.2.5. Processing Services

1. Processing Services are not associated with specific datasets.

2. They provide operations for processing or transforming data in a manner determined by user-specified parameters.

3. They can be tightly or loosely coupled with other services such as the Data and Portrayal Services.

4. The most common ***examples of processing services*** are:

1) **Coordinate Transformation Services (CTS)**:

a) Convert spatial coordinates from one reference system to another;

b) *Applicable implementation specification: Coordinate*

2) ***Image Processing Services***, which include:

a) **Image Manipulation Services**:

– Manipulate images (resizing, changing color and contrast values, applying various filters, manipulating image resolution, etc.);

– Are used for conducting mathematical analyses of image characteristics (computing image histograms, convolutions, etc.);

b) **Image Exploitation Services**:

– Support the photogrammetric analysis of remotely sensed and scanned imagery;

– Support the generation of reports and other products based on the results of the analysis.

c) **Image Synthesis Services**:

– Create or transform images using computer-based spatial models, perspective transformations, and manipulations of image characteristics to improve visibility, sharpen resolution, and/or reduce the effects of cloud cover or haze;

3) **Spatial Analysis Services**:

a) Exploit information available in a Feature or Feature Collection;

b) Derive application-oriented quantitative results that are not available from the raw data itself.

4) **Gazetteers**:

a) Provide access to geospatial data indexed by placename rather than by coordinate locations;

b) *Applicable implementation specification: Gazetteer service profile of a WFS.*

7.2.6. SDI Service Chaining

1. **Chaining services** can be considered as a special case of processing services (or separate service category), enabling the combination or pipelining of results from different services in response to clients' requests.

2. Efficient service chaining is critical to your ability to leverage and combine multiple information sources hosted by various service providers.

3. The key to achieving such efficiency relies on the use of standard interfaces and encodings in the design of the underlying services.

4. Service chaining is required when a task needed by a client cannot be provided by a single service, but rather by

5. Indeed, most GIS applications will require the chaining of multiple spatial and non-spatial services.

6. *Figure 7.2* shows a **typical Service Chaining scenario** where:

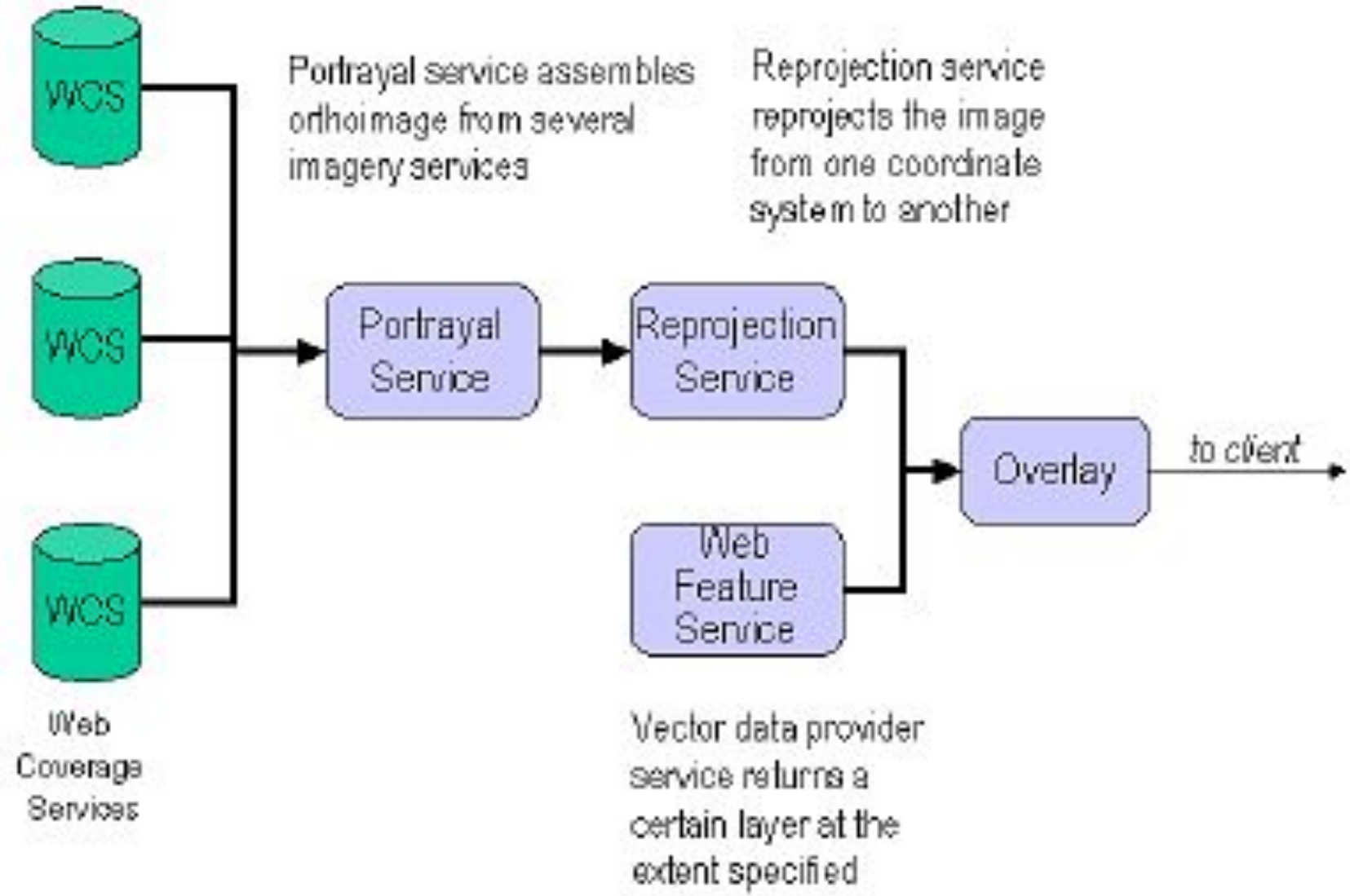
1) Coverage Portrayal Service (CPS) fetches several GIS coverages from different WCS services;

2) Then CPS mosaics them to portray the resulting composite image;

3) Processing Service reprojects the resultant coverage to another spatial reference system;

4) Overlay Service then supplements the coverage with features extracted from a WFS, and sends the result to the

Fig.7.2 – A typical Service Chaining example



7. To date, ***three general Service Chaining methods*** have been identified according to ISO 19119:

1) **User-defined Transparent Chaining**, where:

a) The user defines and controls the order and execution of the individual services;

b) Method requires deep involvement of the client, which may hinder a wide-base adoption of spatial web services;

2) **Opaque Chaining**, where:

a) The chaining of service is performed by a new aggregate service;

b) Aggregate services bundle static (predefined) chains of services and present them to the client as one;

3) **Workflow-managed Translucent Chaining** where:

a) The execution of the chain is managed by a mediating service;

b) Mediating services can act as gateways to other services by coordinating between multiple services without necessarily storing any data of their own.

8. Chaining of spatial services (possibly in conjunction with other non-spatial services) is still considered an area of active research both from the conceptual and implementation perspectives.

7.3. Implementation approach to SDI services

1. There are few existing standards and protocols for providing spatial domain services in an interoperable manner.

2. If you need to implement any of these services in your production environment, it is advisable that you first try to reuse existing interfaces to the extent possible.

3. You should also work with others in your field and with applicable standards bodies to design standard interfaces that can meet your needs.

4. By ensuring that new services fit within the described OGC Service Framework and are consistent with existing standards and abstract specifications, you contribute to the sustainability and extensibility of architectures based on that framework.

5. In terms of supporting technologies, work is underway within OGC to define a **suite of Web Service Interfaces** that have explicit bindings for both HTTP GET and POST (e.g. the WMS, WFS and WCS specifications).

6. In this case, XML is very fundamental as it provides the extensibility and vendor, platform and language independence that are key to the loosely coupled standards based

7. As ***for Service Chaining***, work is still under way to enable it using existing and emerging ***XML technologies***, such as:

1) **The Web Services Description Language (*WSDL*)**, which:

a) Provides a way to describe the messages and operations of a service in an abstract way and bind them to a concrete protocol and message format;

b) In the case of GIS services, describing the service interfaces is often not enough;

2) **The Universal Description, Discovery and Integration (*UDDI*)** which:

a) Enables businesses to quickly and dynamically find and transact with each other;

3) **The Simple Object Access Protocol (*SOAP*)** which;

– Provides a simple and light-weight mechanism of exchanging structured and typed information between peers in a decentralized distributed environment;

4) ***DAML-based Web Service Ontology (DAML-S)*** which:

– Supplies Web Service providers with a core set of markup language constructs for describing the properties and capabilities of their Web Services;

5) **The Business Process Execution Language for Web Services (*BPEL4WS*)** which:

a) Defines a notation for specifying business process behavior based on Web Services;

b) Is a standard promoted by Microsoft, IBM etc.

8. It remains to be seen **how the listed technologies (and others)** can be leveraged for service description, discovery and chaining **within the spatial domain**.

9. As shown in *Figure 7.3*, in service environment, it will not be necessary for players to build comprehensive systems in order to gain a share of the market.

10. The new environment can open the door to small niche players to enter this market with application specific offerings that leverage their understanding of particular industries or processes.

Fig.7.3 – Potential value chain for a service-based GIS marketplace